

IN THE CLAIMS

1. (Canceled).

2. (Original) A sample dispensing apparatus comprising a probe for sucking and ejecting a sample, a dispensing syringe for generating a pressure in said probe to suck and eject the sample, a dispensing flow passage connecting said probe and said dispensing syringe, and a control unit for controlling sucking and ejection operations of the sample, the apparatus further comprising:

at least one pressure sensor for detecting a pressure in said dispensing flow passage;

pressure value storing means for time-serially storing output values of said pressure sensor during an operation of dispensing the sample;

storage means for storing a reference database consisted of time-serial output values of said pressure sensor, which are obtained when the sample is normally sucked or ejected by said probe; and

determining means for determining an abnormality of sample dispensing by comparing the Mahalanobis distance calculated from both comparison data prepared based on the output values of said pressure sensor time-serially stored in said pressure value storing means and said reference database, with a preset threshold.

3. (Original) A sample dispensing apparatus according to Claim 2, wherein said reference database is prepared depending on an amount of dispensed sample, and the abnormality of sample dispensing is determined by comparing the Mahalanobis distance calculated from both said comparison data and reference database corresponding to the amount of dispensed sample, with a preset threshold.

4. (Currently amended) A sample dispensing apparatus comprising a probe for sucking and ejecting a sample, a dispensing syringe for generating a pressure in said probe to suck and eject the sample, a dispensing flow passage connecting said probe and said dispensing syringe, and a control unit for controlling sucking and ejection operations of the sample, said apparatus further comprising:

at least one pressure sensor for detecting a pressure in said dispensing flow passage;

pressure value storing means for time-serially storing output values of said pressure sensor during an operation of dispensing the sample;

storage means for storing a reference database consisted of time-serial output values of said pressure sensor, which are obtained when the sample is normally sucked or ejected by said probe; and

determining means for carrying out multi-variable analysis of both said reference database and comparison data

created based on the output values of said pressure sensor time-serially stored in said pressure value storing means, and for determining the presence or absence of an abnormality in the dispensing operation of the sample based on an analysis result;

~~A sample dispensing apparatus according to Claim 1, wherein the determining means includes discriminating means for, when the abnormality of sample dispensing is detected, comparing a pressure value immediately before the end of the sample sucking operation with a preset threshold, and for discriminating a cause of the dispensing abnormality.~~

5-6. (Canceled)

7. (Currently amended) ~~A sample dispensing apparatus according to Claim 5, A sample dispensing apparatus comprising a probe for sucking and ejecting a sample, a dispensing syringe for generating a pressure in said probe to suck and eject the sample, a dispensing flow passage connecting said probe and said dispensing syringe, and a control unit for controlling sucking and ejection operations of the sample, said apparatus further comprising:~~

at least one pressure sensor for detecting a pressure in said dispensing flow passage;

pressure value storing means for time-serially storing output values of said pressure sensor during an operation of

dispensing the sample;

storage means for storing a reference database consisted of time-serial output values of said pressure sensor, which are obtained when the sample is normally sucked or ejected by said probe; and

determining means for carrying out multi-variable analysis of both said reference database and comparison data created based on the output values of said pressure sensor time-serially stored in said pressure value storing means, and for determining the presence or absence of an abnormality in the dispensing operation of the sample based on an analysis result;

wherein the determining means includes dispensing-function abnormality determining means for, when a fluid having a known physical property falling within a predetermined range of said physical property for samples handled by said sample dispensing apparatus, is dispensed as the sample, determining the abnormality of dispensing and determining the presence or absence of an abnormality in a dispensing function of said sample dispensing apparatus, by reference to said time-serial output values of said reference database, stored for a reference sample having the known physical property falling within said predetermined range; and

wherein the determining means includes recording means for routinely determining the abnormality of dispensing and time-serially recording determination results, and means for

discriminating the extent of deterioration in the dispensing function of said sample dispensing apparatus.

8. (Currently amended) A sample dispensing apparatus ~~according to Claim 1, further comprising comprising a probe for sucking and ejecting a sample, a dispensing syringe for generating a pressure in said probe to suck and eject the sample, a dispensing flow passage connecting said probe and said dispensing syringe, and a control unit for controlling sucking and ejection operations of the sample, said apparatus further comprising:~~

at least one pressure sensor for detecting a pressure in said dispensing flow passage;

pressure value storing means for time-serially storing output values of said pressure sensor during an operation of dispensing the sample;

storage means for storing a reference database consisted of time-serial output values of said pressure sensor, which are obtained when the sample is normally sucked or ejected by said probe;

determining means for carrying out multi-variable analysis of both said reference database and comparison data created based on the output values of said pressure sensor time-serially stored in said pressure value storing means, and for determining the presence or absence of an abnormality in the dispensing operation of the sample based on an analysis

result; and

cleaning means for washing the interior of said dispensing flow passage including said sample probe; [[and]] wherein said sample dispensing apparatus has a function of, when the abnormality of sample dispensing is detected, washing the interior of said dispensing flow passage including said sample probe, then dispensing a fluid having a known physical property falling within a predetermined range of said physical property for samples handled by said sample dispensing apparatus, and determining the dispensing abnormality in the fluid dispensing by reference to said time-serial output values of said reference database, stored for a reference sample having the known physical property falling within said predetermined range, thereby determining whether the dispensing function of said sample dispensing apparatus is restored.

9. (Original) A sample dispensing apparatus according to Claim 8,

wherein said sample dispensing apparatus has a function of stopping the dispensing operation when the abnormality of sample dispensing is detected and thereafter the dispensing function of said sample dispensing apparatus is not restored even after repeating the washing a predetermined number of times.

10. (Currently amended) An automatic analyzer including a sample dispensing apparatus according to Claim 1, comprising a probe for sucking and ejecting a sample, a dispensing syringe for generating a pressure in said probe to suck and eject the sample, a dispensing flow passage connecting said probe and said dispensing syringe, and a control unit for controlling sucking and ejection operations of the sample, said apparatus further comprising:

at least one pressure sensor for detecting a pressure in said dispensing flow passage;

pressure value storing means for time-serially storing output values of said pressure sensor during an operation of dispensing the sample;

storage means for storing a reference database consisted of time-serial output values of said pressure sensor, which are obtained when the sample is normally sucked or ejected by said probe;

determining means for carrying out multi-variable analysis of both said reference database and comparison data created based on the output values of said pressure sensor time-serially stored in said pressure value storing means, and for determining the presence or absence of an abnormality in the dispensing operation of the sample based on an analysis result; and

a cleaning bath for cleaning an outer surface of a sample probe, a reaction vessel cleaning mechanism, and a reaction

vessel repeatedly used after being washed by said reaction vessel cleaning mechanism,

wherein said automatic analyzer has a function of, when an abnormality of dispensing is detected during suction of a sample, discarding the sample into said cleaning bath without ejecting the sample into said reaction vessel.

11. (Original) An automatic analyzer including a sample dispensing apparatus according to Claim 4,

wherein said automatic analyzer has a function of, when an abnormality of sample dispensing is detected, finding out a cause of the dispensing abnormality from among a plurality of classified causes and displaying the found-out cause.

12. (Original) An automatic analyzer according to Claim 11,

wherein said automatic analyzer has a function of displaying the cause of the dispensing abnormality and performing a counteraction corresponding to the cause.

13. (Currently amended) An automatic analyzer including a sample dispensing apparatus according to Claim 1, comprising a probe for sucking and ejecting a sample, a dispensing syringe for generating a pressure in said probe to suck and eject the sample, a dispensing flow passage connecting said probe and said dispensing syringe, and a control unit for

controlling sucking and ejection operations of the sample,  
said apparatus further comprising:

at least one pressure sensor for detecting a pressure in  
said dispensing flow passage;

pressure value storing means for time-serially storing  
output values of said pressure sensor during an operation of  
dispensing the sample;

storage means for storing a reference database consisted  
of time-serial output values of said pressure sensor, which  
are obtained when the sample is normally sucked or ejected by  
said probe; and

determining means for carrying out multi-variable  
analysis of both said reference database and comparison data  
created based on the output values of said pressure sensor  
time-serially stored in said pressure value storing means, and  
for determining the presence or absence of an abnormality in  
the dispensing operation of the sample based on an analysis  
result;

wherein said automatic analyzer has a function of, when  
an abnormality of sample dispensing is detected, repeatedly  
dispensing the relevant sample within a predetermined number  
of times.

14. (Currently amended) An automatic analyzer including  
a sample dispensing apparatus according to ~~Claim 1~~, comprising  
a probe for sucking and ejecting a sample, a dispensing

syringe for generating a pressure in said probe to suck and eject the sample, a dispensing flow passage connecting said probe and said dispensing syringe, and a control unit for controlling sucking and ejection operations of the sample, said apparatus further comprising:

at least one pressure sensor for detecting a pressure in said dispensing flow passage;

pressure value storing means for time-serially storing output values of said pressure sensor during an operation of dispensing the sample;

storage means for storing a reference database consisted of time-serial output values of said pressure sensor, which are obtained when the sample is normally sucked or ejected by said probe; and

determining means for carrying out multi-variable analysis of both said reference database and comparison data created based on the output values of said pressure sensor time-serially stored in said pressure value storing means, and for determining the presence or absence of an abnormality in the dispensing operation of the sample based on an analysis result;

wherein said automatic analyzer has a function of, when an abnormality of sample dispensing is detected and then the dispensing abnormality still continues even after repeatedly dispensing the relevant sample within a predetermined number of times, canceling the dispensing of the relevant sample and

starting to dispense a next sample.

15. (Canceled).

16. (Previously presented) A sample dispensing apparatus according to Claim 2, comprising:

discriminating means for, when the abnormality of sample dispensing is detected, comparing a pressure value immediately before the end of the sample sucking operation with a preset threshold, and for discriminating a cause of the dispensing abnormality.

17. (Previously presented) A sample dispensing apparatus according to Claim 2,

wherein the determining means includes dispensing-function abnormality determining means for, when a fluid having a known physical property falling within a predetermined range of said physical property for samples handled by said sample dispensing apparatus, is dispensed as the sample, determining the abnormality of dispensing and determining the presence or absence of an abnormality in a dispensing function of said sample dispensing apparatus, by reference to said time-serial output values of said reference database, stored for a reference sample having the known physical property falling within said predetermined range.

18. (Previously presented) A sample dispensing apparatus according to Claim 17,

wherein said sample dispensing apparatus has a function of determining the abnormality of dispensing each time said sample dispensing apparatus is started up, and determining the presence or absence of the abnormality in the dispensing function of said sample dispensing apparatus.

19. (Previously presented) A sample dispensing apparatus according to Claim 17,

wherein the determining means includes recording means for routinely determining the abnormality of dispensing and time-serially recording determination results, and means for discriminating the extent of deterioration in the dispensing function of said sample dispensing apparatus.

20. (Currently amended) A sample dispensing apparatus according to Claim 2, further comprising:

cleaning means for washing the interior of said dispensing flow passage including said sample probe; and

wherein said sample dispensing apparatus has a function of, when the abnormality of sample dispensing is detected, washing the interior of said dispensing flow passage including said sample probe, then dispensing a fluid having a known physical property falling within a predetermined range of said physical property for samples handled by said sample

dispensing apparatus, and determining the dispensing abnormality in the fluid dispensing by reference to said time-serial output values of said reference database, stored for a reference sample having the known physical property falling within said predetermined range, thereby determining whether the dispensing function of said sample dispensing apparatus is restored.

~~cleaning means for washing the interior of said dispensing flow passage including said sample probe, and wherein said sample dispensing apparatus has a function of, when the abnormality of sample dispensing is detected, washing the interior of said dispensing flow passage including said sample probe, then dispensing a fluid having a known physical property, such as viscosity and density, and determining the dispensing abnormality in the fluid dispensing, thereby determining whether the dispensing function of said sample dispensing apparatus is restored.~~

21. (Previously presented) An automatic analyzer including a sample dispensing apparatus according to Claim 16, wherein said automatic analyzer has a function of, when an abnormality of sample dispensing is detected, finding out a cause of the dispensing abnormality from among a plurality of classified causes and displaying the found-out cause.

22. (Previously presented) An automatic analyzer

including a sample dispensing apparatus according to Claim 21,  
wherein said automatic analyzer has a function of  
displaying the cause of the dispensing abnormality and  
performing a counteraction corresponding to the cause.

23. (Previously presented) A method of detecting an abnormality during sample dispensing, comprising the steps of:  
sucking a sample by using a probe;  
time-serially storing output values of a pressure sensor representing pressures in said probe and detected during said sucking step;  
creating comparison data based on the stored output values of said pressure sensor; and  
determining an abnormality of sample dispensing by comparing the Mahalanobis distance calculated from both the comparison data and a reference database consisting of the time-serial output values of said pressure sensor, which are obtained when the sample is normally sucked or ejected by said probe, with a preset threshold.